

REMARKS

Method claims 1 to 28 remain in this application. Applicant has cancelled apparatus claims 29 to 31 to expedite prosecution of this application.

The subject application relates to a method for evaluating the characteristics of a patterned semiconductor wafer. The method includes directing a probe beam of X-rays to the surface of the sample where the size of the probe beam spot is larger than the feature size of the patterns on the wafer. The reflected probe beam is measured and analyzed to evaluate the wafer.

In the Office Action, the Examiner rejected the claims as being obvious in view of the patent to Koppel (USP 5,619,548). Applicants agree with the Examiner that Koppel discloses an X-ray inspection system for semiconductor wafers. Koppel teaches focusing a probe beam of radiation on the wafer surface. Koppel teaches measuring the reflected beam and evaluating the wafer based on the measurements. Koppel describes taking measurements on a test sample which includes a thin film layer disposed on a substrate. (Col 3, line 18+) As recognized by the Examiner, Koppel fails to teach using his apparatus to measure patterned wafers where the feature size of the pattern is less the probe beam spot size.

The Examiner also alleges that Koppel teaches a probe beam spot that is large relative to the feature size of the pattern on a patterned wafer. However, applicant can find no such teaching in Koppel. In fact, Koppel does not disclose the size of his measurement spot nor does he mention the relationship of the spot size to the feature size on a patterned wafer.

Nonetheless, for argument purposes, let us assume that one skilled in the art would recognize that the Koppel device would generate a relatively large spot size and that this spot size would be large compared with the feature size on a patterned wafer. Based on such an assumption, the Examiner argues that one skilled in the art would find it obvious to use the apparatus in Koppel to measure on a patterned wafer. In fact, ***just the opposite is true***. Prior to the teachings of the applicant, one skilled in the art who understood that the beam spot size was larger than the patterned features would ***not*** find it obvious to measure a patterned wafer. Indeed, one skilled in the art would have believed that the patterns etched into the wafer would degrade the measurements such that any effort to evaluate a patterned wafer would be unlikely to produce satisfactory results. It was applicant who realized that small variations in the upper surface layers would not prevent measurement of the underlying layers.

Claims 1 to 28 define this new and unobvious method of measuring a semiconductor wafer. Applicant has cancelled the apparatus claims to avoid a rejection based on the premise that the claimed apparatus is not different from the prior device. Claims 1 to 28, on the other hand, define *a new method* of using a device to obtain measurements on patterned wafers and such a new and non-obvious use is patentable.


In the Office Action, the Examiner argued that the intended use must result in a "structural change." This is clearly not correct as a method claim, by definition, does not recite structure. This is also not a situation where the operation of the prior art device as described in Koppel "inherently" performed the method claimed herein, since there is no indication in Koppel the measurements were made on patterned wafers. The Examiner also argues that in a process claim, the "intended use must result in a manipulative difference as compared to the prior art." Applicant has not found any support for the statement, but in fact, the claims recite the specific relationship between the spot size and the feature size which is a manipulative difference.

In summary, it is respectfully submitted that one skilled in art, having knowledge of a prior art X-ray measurement system which generated a relatively large spot size would not have been motivated to measure a patterned wafer with small feature sizes, absent the teachings supplied by the applicant that such a measurement could be made successfully. The Examiner's contrary conclusion is not supported by anything in the prior art and, in fact, is opposite to the conclusion that one skilled in the art would likely have reached. Accordingly, it is submitted that pending method claims 1 to 28 define patentable subject matter and allowance thereof is respectfully solicited.

Respectfully submitted,

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